



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF RADIATION AND INDOOR AIR  
National Air and Radiation Environmental Laboratory  
540 South Morris Avenue, Montgomery, AL 36115-2601  
(334) 270-3400

RESPONSE & PREVENTION BRANCH  
99 MAR 10 PM 2:32

March 9, 1999

**MEMORANDUM**

**SUBJECT:** Radiochemical Results for  
Crossland Site Sample

**FROM:** John Griggs, Chief *John Griggs*  
Monitoring and Analytical Services Branch

**TO:** Eric Simpson, Coordinator  
Radiation Monitoring and Analytical Programs  
Region 2

Attached is a data package for gamma analysis of a smear sample collected from the Crossland Site in Caugus, Puerto Rico. The sample constitutes NAREL batch number 9900005.

Radiochemical analyses usually require the subtraction of an instrument background measurement from a gross sample measurement. Both values are positive, but when the sample activity is low, random variations in the two measurements can cause the gross value to be less than the background, resulting in a measured activity less than zero. Although negative activities have no physical significance, they do have statistical significance, as for example in the evaluation of trends or the comparison of two groups of samples.

For all analyses except gamma spectroscopy, it is the policy of NAREL to report results as generated, whether positive, negative, or zero, together with the 2-sigma measurement uncertainty and a sample-specific estimate of the minimum detectable concentration (MDC). The activity, uncertainty, and MDC are given in the same units. The activity and 2-sigma uncertainty for a radionuclide measured by gamma spectroscopy are reported only if the nuclide is detected; so, the results of gamma analyses are never zero or negative. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Cs-137, I-131, K-40, Ra-226, and Ra-228. If one of these six nuclides is undetected, NAREL reports it as "Not Detected," or "ND," and provides a sample-specific estimate of the MDC.

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Specific information concerning all aspects of the radiological analysis of the samples is contained in the batch case narrative of the data package. If you have any questions concerning the analytical results, please contact me at (334)270-3450.

**Attachments**

cc: Paul Giardina, Region 2, w/o attachments  
Mary Clark, (6601J), w/o attachments  
Ed Sensintaffar, NAREL

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES**

**REPORT OF SAMPLE DELIVERY GROUP #9900005**

Project: CROSSLAND SITE  
Analysis Procedure: Gamma spectroscopy  
Date Reported: 03/08/1999

**SAMPLES**

NAREL Sample #	Client Sample ID	Type	Matrix	Date Collected	Date Received
99.00723H	EXPOSURE DEVICE #402	SAM	SMEAR	01/27/1999	02/08/1999

**EXCEPTIONS**

1. Packaging and Shipping - No problems were observed.
2. Documentation - No problems were observed.
3. Sample Preparation - No problems were encountered.
4. Analysis - This sample consisted of two cotton swabs in a plastic bag. The sample was analyzed for gamma emitters by counting on a high purity germanium detector. The calibration geometry used for the analysis was not identical to the sample. Therefore, the results should be viewed as qualitative only.
5. Holding Times - All holding times were met.

**QUALITY CONTROL**

1. QC samples - All QC analysis results met NAREL acceptance criteria.
2. Instruments - Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.

**CERTIFICATION**

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Chief of the Monitoring and Analytical Services Branch and the NAREL Quality Assurance Coordinator, or their designees, as verified by the following signatures.

James B. Moore 3/9/99  
James B. Moore Date  
Quality Assurance Coordinator

John Griggs 3/9/99  
John Griggs, Ph.D. Date  
Chief, Monitoring and Analytical Services Branch

## GENERAL INFORMATION

### SAMPLE TYPES

BLD	Blind sample
DBD	Double blind sample
FBK	Field blank
SAM	Normal sample

### ANALYSIS QC TYPES

ANA	Normal analysis
DUP	Laboratory duplicate
LCS	Laboratory control sample (blank spike)
MS	Matrix spike
MSD	Matrix spike duplicate
RBK	Reagent blank

### QUALITY INDICATORS

RPD	Relative Percent Difference
%R	Percent Recovery
Z	Number of standard deviations by which a QC measurement differs from the expected value

### EVALUATION OF QC ANALYSES

A reagent blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "Z scores." A Z score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The Z score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The Z score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the Z score is computed.

Each standard uncertainty used to compute a Z score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of reagent blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

## GENERAL INFORMATION (CONTINUED)

### GAMMA ANALYSIS

The reporting format lists the gamma emitters in alphabetical order. The activity and 2-sigma uncertainty for radionuclides measured by gamma spectroscopy are reported only if the nuclide is detected. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Co-60, Cs-137, I-131, K-40, Ra-226 and Ra-228. If one of these seven nuclides is undetected, NAREL reports it as "Not Detected" or "ND", and provides a sample-specific estimate of the MDC.

Due to potential spectral interferences and other possible problems associated with the determination of the activity of certain radionuclides, the activities for Th-234, Pa-234m, Ra-226, and U-235 are subject to greater possible error than other commonly reported radionuclides. It should be noted that this potential error is not included in the two-sigma counting error which is reported with each activity. Although in this report we do provide the calculated activities for these radionuclides, we recommend that the results be used only as a qualitative means of indicating the presence of these radionuclides and not as a quantitative measure of their concentration. The results for these nuclides are not used in the evaluation of quality control samples. Furthermore, because of mutual interference between Ra-226 and U-235, NAREL's gamma analysis software tends to overestimate the amounts of these nuclides whenever both are present in a sample. Lower estimates for Ra-226 activities can be obtained from the reported activities of its decay products, Pb-214 and Bi-214, which are likely to be somewhat less than the Ra-226 activity because of the potential escape of radon gas.

NAREL's gamma spectroscopy software corrects activities and MDCs for decay between collection and analysis, but only up to a limit of ten half-lives. So, if the decay time for a sample is more than ten half-lives of a radionuclide, that nuclide will almost always be undetected and the reported MDC will be meaningless. This is usually a problem only for short-lived radionuclides, such as I-131 and Ba-140, when there is a long delay between collection and analysis.

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES  
SDG #9900005**

**ANALYSIS SUMMARY**

**Analysis Procedure:** GAMMA  
**Title:** Gamma spectroscopy

NAREL Sample #	QC Type	Preparation Procedure	Date Completed	Prep Batch #	QC Batch #
99.00723H		N/A	02/17/1999	0001427E	0000832A
99.00723H	DUP	N/A	02/25/1999	0001604D	0000832A

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

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GAMMA ANALYSES  
SDG #9900005**

**SAMPLE ANALYSIS REPORT**

Sample #:	99.00723H	QC batch #:	0000832A
Matrix:	SMEAR	Prep batch #:	0001427E
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: SAMPLE CONSISTS OF TWO Q-TIPS

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
02/16/1999 14:44	1000.0	GE11	KNG

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Ba140	ND		8.3e+00	PCI	01/27/1999
Co60	ND		1.2e+00	PCI	01/27/1999
Cs137	ND		9.2e-01	PCI	01/27/1999
I131	ND		4.1e+00	PCI	01/27/1999
K40	ND		1.4e+01	PCI	01/27/1999
Ra226 *	ND		1.2e+01	PCI	01/27/1999
Ra228	ND		3.9e+00	PCI	01/27/1999

\* An asterisk indicates a result whose value may be significantly over or underestimated.

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GAMMA ANALYSES  
SDG #9900005**

**SAMPLE ANALYSIS REPORT**

Sample #:	99.00723H	QC batch #:	0000832A
Matrix:	SMEAR	Prep batch #:	0001604D
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	DUP

Comment: SAMPLE CONSISTS OF TWO Q-TIPS

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
02/24/1999 14:53	1000.0	GE10	MHW

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Ba140	ND		1.7e+01	PCI	01/27/1999
Co60	ND		1.9e+00	PCI	01/27/1999
Cs137	ND		1.2e+00	PCI	01/27/1999
I131	ND		1.1e+01	PCI	01/27/1999
K40	1.25e+01	7.7e+00		PCI	01/27/1999
Ra228	ND		4.8e+00	PCI	01/27/1999



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NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
GAMMA ANALYSES  
SDG #9900005**

**QC BATCH SUMMARY**

QC batch #: 0000832A  
Preparation procedure: N/A  
Analysis procedure: GAMMA

NAREL Sample #	QC Type	Yield (%)	$\pm 2\sigma$ Uncertainty (%)	Analyst
99.00723H 99.00723H	DUP	N/A N/A		N/A N/A

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**National Air and Radiation Environmental Laboratory  
QC Batch Report**

QC Batch #: 0000832A

Analytical Procedure: GAMMA

**LABORATORY DUPLICATES (PCI/SAMP)**

Sample ID	Nuclide	Original $\pm 2\sigma$	Duplicate $\pm 2\sigma$	RPD	Z
99.00723H	BA140				
99.00723H	CO60				
99.00723H	CS137				
99.00723H	I131				
99.00723H	K40		1.25e+01 $\pm$ 7.7e+00		
99.00723H	RA228				

Analyst: \_\_\_\_\_

QA Officer: \_\_\_\_\_

*Mark McLean*

*3/8/99*

RESPONSE & PREVENTION  
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